FACTS ABOUT RESPIRATORY PROTECTION FOR PUBLIC EMPLOYEES

NEW JERSEY DEPARTMENT of HEALTH and SENIOR SERVICES

Division of Epidemiology, Environmental and Occupational Health

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What Is a Respirator?

A respirator is an enclosure that covers the nose and mouth or the entire face or head. Respirators can have two general types of fit: (1) tight-fitting—that is, quarter masks, which cover the mouth and nose; and half masks, which cover the face from the hairline to below the chin; and full face masks which cover the entire face; and (2) loose-fitting, such as hoods, helmets, blouses, or full suits that cover the head completely.

There are two major classes of respirators: (1) air-purifying to remove contaminants from the air, and (2) atmosphere-supplying to provide clean, breathable air from an uncontaminated source. As a general rule, the latter-type respirator is used for more hazardous exposures.

Why Do Employees Need Respirators?

Some of the most common hazards to employees' lungs are the lack of oxygen and the presence of harmful dusts, fogs, smokes, mists, fumes, gases, vapors, or sprays including substances that may cause adverse neurological effects, lung impairment and cancer.

There are many workplace situations that involve toxic substances and for which engineering controls may be inadequate to control exposures, and respirators are used in these situations as a back-up method of protection. Respirators can also protect against oxygen-deficient atmospheres. Increased breathing rates, accelerated heartbeat, and impaired thinking or coordination occur more quickly in an oxygen-deficient atmosphere. Even a momentary loss of coordination may be devastating to a worker if it occurs while the worker is performing a potentially dangerous activity, such as climbing a ladder.

When Do Employees Need to Wear Respirators?

Respirators must be used during cleanup operations, when effective engineering controls are not feasible, or when engineering controls are being installed.

The prevention of atmospheric contamination at the worksite generally should be accomplished as far as feasible, by engineering control measures—such as enclosing or confining the contaminant-producing operation, local exhausting of the contaminant—or substituting with less toxic materials.

Respirators have their limitations and are not a substitute for effective engineering controls. Where respirators are required to protect worker health, specific procedures are necessary to overcome any potential deficiencies and to ensure the effectiveness of the equipment.

What Procedures Are Necessary to Ensure Proper Protection?

The Public Employees Occupational Safety and Health Program's (PEOSH) Respirator Standard (29 CFR 1910.134) requires that employers establish and maintain an effective respiratory protection program—different hazards require different respirators—and employees are responsible for wearing the respirator and complying with the program.

The standard contains requirements for program administration, worksite-specific procedures, respirator selection, employee training, fit testing, medical evaluation, respirator use, cleaning, maintenance, and repair.

Respirators must be used while effective engineering controls, if they are feasible, are being installed. If engineering controls are not feasible, employers must provide respirators, and employees must wear them when it is necessary to protect their health. The respirators issued to the employee must be properly selected, used, and maintained for a particular work environment and contaminant, and employees must be trained in all aspects of the respiratory protection program.

How Do You Develop An Effective Respirator Program?

When planning a program to control occupational illness caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, vapors, or sprays, the primary objective should be prevention.

Responsibility for the program must rest with one person. The program administrator must have sufficient knowledge of the subject to supervise the program properly. Larger public employers with industrial hygiene, health physics, medical, safety engineering, or fire prevention departments should administer the program in liaison with the program administrator. For smaller employers that do not have industrial hygiene, health physics, safety engineering, or fire prevention departments, the program must be administered by an upper-level superintendent, foreman, or qualified person.

Any respirator program should stress thorough training of all users. Employees must be aware that the respirators do not eliminate the hazards. If the respirator fails, overexposure will occur. To reduce the possibility of failure, respirators must fit properly and be maintained in a clean and serviceable condition. Employers and employees must understand the respirator's purpose and its limitations. The respirator must not be altered or removed by the wearer even for a short time, despite the fact the wearer may find it uncomfortable.

An effective respirator program must cover the following factors:

- written worksite specific procedures;
- program evaluation;
- selection of approved respirators;
- training;
- fit testing;
- inspection, cleaning, maintenance and storage;
- medical evaluations;
- work area surveillance;
- air quality standards.

When respirator use is required, employers must have written operating procedures for the safe and proper use of respirators. Users must be familiar with these procedures as well as with available respirators, and their limitations. In workplaces with no hazardous exposures, but where there is voluntary respirator use, certain written program elements may be necessary to prevent potential hazards associated with respirator use.

The effectiveness of a respirator program must be evaluated regularly and the written operating procedure modified as necessary to reflect the evaluation results. The use of a labor-management team may be effective for the periodic evaluation.

How Do You Choose the Correct Respirator?

Choosing the right equipment involves determining what the hazard is, choosing approved equipment, and ensuring that the device is certified by the National Institute for Occupational Safety and Health (NIOSH). Equipment must be used pursuant to the conditions accompanying the certification.

Chemical and physical properties of the contaminant, as well as the toxicity and concentration of the hazardous material and the amount of oxygen present, must be considered in selecting the proper respirators. The nature and extent of the hazard, work rate, area to be covered, mobility, work requirements and conditions, as well as the limitations and characteristics of the available respirators also are selection factors.

Air-purifying respirators use filters or sorbents to remove harmful substances from the air. They range from simple disposable masks to sophisticated devices.

Air-purifying respirators do not supply oxygen and may not be used in oxygen-deficient atmospheres or in ones that are immediately dangerous to life or health (IDLH). Atmosphere-supplying respirators are designed to provide breathable air from a clean air source other than the surrounding contaminated work atmosphere. They range from supplied-air respirators and self-contained breathing apparatus (SCBA) to complete air-supplied suits.

Time

- The time needed to perform a given task, including the time necessary to enter and leave a contaminated area, is one factor that determines the type of respiratory protection needed. For example, SCBAs, gas-masks, or air-purifying chemical-cartridge respirators provide respiratory protection for relatively short periods whereas a type of atmosphere-supplying respirator that supplies breathable air from an air compressor through an air line can provide protection for extended periods of time. Particulate filter air-purifying respirators can provide protection for long periods without the need of filter replacement **only** if the total concentration of atmospheric particulates is low. Where there are higher concentrations of contaminants, however, an atmosphere-supplying respirator such as the positive-pressure supplied-air respirator (SAR) offers the advantage of better protection and longer duration.

  The use of SARs also avoids the need to be concerned about determining filter breakthrough times, change schedules, or using end-of-service-life indicators (ESLI) for airborne toxic materials, a factor that must be considered when using air-purifying respirators. SARs also cause less discomfort than air-purifying respirators because the wearer need not overcome filter resistance when inhaling.

Interference with Movement

- Air-purifying respirators present minimal interference with the wearer's movement. Atmosphere-supplying respirators, however, may restrict movement and present potential hazards. For example, SARs with their trailing hoses, can limit the area the wearer can cover and may present a potential hazard where the trailing hose can come into contact with machinery. Similarly, an SCBA—a respirator that includes a back-mounted, compressed-air cylinder—presents both a size and weight burden. This may restrict

climbing and movement in tight places, and carrying the added weight of the air cylinder presents an additional stress.

Breathing Volume

- Another factor to consider when using respirators is the air-supply rates. The wearer's work rate determines the volume of air breathed per minute. The volume of air supplied to meet the breathing requirements is of great significance when using atmosphere-supplying respirators such as self-contained and air-line respirators that use cylinders because this volume determines their operating life. The useful service life of these respirators under even moderate working conditions may be significantly less than under conditions of rest.

  The peak airflow rate also is important in the use of a constant-flow SAR. The air-supply rate should always be greater than the maximum amount of air being inhaled in order to maintain the respiratory enclosure under positive pressure.

  Higher breathing resistance of air-purifying respirators under conditions of heavy work may result in distressed breathing. A person working in an area of high temperature or humidity is under stress. Additional stress resulting from the use of a respirator should be minimized by using one having a minimal weight and a minimal breathing resistance when these can be fitted properly to the wearer.

Warning of Remaining Service Life

- Some type of warning as to the remaining service life is available for SCBAs and for some chemical canister respirators. This may be a pressure gauge or timer with an audible alarm for SCBAs or a color-end-of-service-life indicator (ESLI) on the cartridge or canister. The user should understand the operation and limitations of each type of warning device. Since many gas masks and chemical-cartridge respirators have no ESLI indicators for their remaining service life, the employer or employee will need to do service life calculations. It is important, therefore, that new canisters and cartridges be used at the beginning of each work shift.

Who Needs to Be Trained?

Supervisors and workers must be trained regarding the proper selection, use, and maintenance of respirators.

All employees required to use respiratory protective equipment must be instructed in the proper use of the equipment and its limitations. Those employees who will be required to use respiratory protective equipment in atmospheres immediately dangerous to life or health must be trained in rescue procedures.

Training must be comprehensive enough so that, when completed, the employee will be able to demonstrate a knowledge of the limitations and capabilities of the respirator, why the respirator is necessary, and how improper fit, usage, or maintenance can compromise the respirator.

Training must include an explanation of the following:

- Nature of the respiratory hazard and what may happen if the respirator is not used properly,
- Engineering and administrative controls being used and the need for the respirator as added protection,

- Reason(s) for the selection of a particular type of respirator,
- Limitations of the selected respirator,
- Methods of donning the respirator, performing a user seal check, and ensuring proper operation,
- Proper wear of the respirator,
- Respirator maintenance and storage, and
- Proper method for handling emergency situations.

Users should know that improper respirator use or maintenance may cause overexposure. They should know that continued use of poorly fitted and maintained respirators can also cause chronic disease or death from overexposure to air contaminants.

How Do You Make Sure The Respirators Fit Properly?

Full facepieces, half masks, quarter masks and even the different brands of the same type of respirator marketed, have different fit characteristics. **No one respirator will fit everyone.** Employers need to have sufficient sizes and models available to achieve proper fit.

Corrective eyeglasses worn by employees also present a problem when fitting respirators. Special mountings are available to hold corrective lenses inside full facepieces. If corrective lenses are needed, the facepiece and lenses must be fitted by a qualified individual to provide good vision, comfort, and proper sealing.

The user must receive fitting instructions including demonstrations and practice in how to wear the respirator, how to adjust it, and how to determine if it fits properly.

Although respirators are designed for maximum efficiency, they cannot provide protection without a tight seal between the facepiece and the face of the wearer. Consequently, beards and other facial hair can substantially reduce the effectiveness of a respirator. The absence of dentures can seriously affect the fit of a facepiece. To ensure proper respiratory protection, a facepiece must be checked each time the respirator is worn. This can be accomplished by performing either a positive-pressure or negative-pressure user seal check. Detailed instructions for performing these tests can be found in Appendix B-1 of the Respiratory Protection Standard (29 CFR 1910.134).

The effectiveness of the fit of the facepiece can be tested two ways: qualitatively and quantitatively. Qualitative fit testing involves the introduction of a harmless odoriferous or irritating substance into the breathing zone around the respirator being worn. If no odor or irritation is detected by the wearer, a proper fit is indicated.

Quantitative fit testing offers more accurate, detailed information on respirator fit. It can involve introducing a harmless aerosol to the wearer while he or she is in a test chamber, the measurement of the ambient particulates in the air, or taking controlled negative-pressure measurements. While the wearer performs exercises that could induce facepiece leakage, the air inside and outside the facepiece is then measured for the presence of an aerosol, ambient particulates, or pressure change, to determine any leakage into the respirator.

What Are Some Specific Respirator Uses?

The following list presents a simplified version of characteristics and factors used for respirator selection. It does not specify the contaminant concentrations or particle size. Some PEOSH substance-specific standards include more detailed information on respirator selection.

Hazard	Respirator
Oxygen Deficiency	
Immediately dangerous to life or health.*	Any positive-pressure SCBA. Combination positive-pressure with auxiliary self-contained air supply.
Not immediately dangerous to life or health.	Any positive-pressure SCBA or supplied-air respirator.
Gas and vapor contaminants	
Immediately dangerous to life or health.	Positive-pressure SCBA. Combination positive- pressure SAR with auxiliary self-contained air supply respirator.
Not immediately dangerous to life or health.	Any positive-pressure SAR. Gas mask. Chemical cartridge respirator.
Particulate contaminants	Any positive-pressure SAR including abrasive blasting respirator. Powered air-purifying respirator equipped with high-efficiency filters. Any air-purifying respirator with a specific particulate filter.
Gaseous and particulate contaminants	
Immediately dangerous to life or health.	Positive-pressure SCBA. Combination positive-pressure SAR with auxiliary self-contained air supply.
Gaseous and particulate contaminants	
Not immediately dangerous to life or health.	Any positive-pressure supplied-air respirator. Gas mask. Chemical-cartridge respirator.
Escape from contaminated atmosphere that may be immediately dangerous to life or health	Any positive-pressure SCBA. Gas mask. Combination positive-pressure SAR with escape SCBA.
Firefighting	Any positive-pressure SCBA.

***Note:** "Immediately dangerous to life or health" (IDLH) is any condition that poses either an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse, delayed effects on health.

How Do You Inspect and Take Care of Respirators?

All respirators must be inspected for wear and deterioration of their components before and after each use. Special attention should be given to rubber or plastic parts that can deteriorate. The face-piece, especially the face seal surface, headband, valves, connecting tube, fittings, and canister must be in good condition. A respirator inspection must include a check of the tightness of the connections.

SCBAs used for emergencies only must be inspected at least monthly. Air and oxygen cylinders must be fully charged according to the manufacturer's instructions. Regulator and warning devices must be checked to ensure their proper function. Records must be kept of inspection dates and findings.

Chemical cartridges and gas mask canisters must be replaced as necessary to provide complete protection. The manufacturer's recommendations must be followed. Mechanical filters must be replaced as necessary to avoid high resistance to breathing.

Repairs must be made only by experienced persons using parts specifically designed for the respirator. The manufacturer's instructions should be consulted for any repair, and no attempt should be made to repair or replace components or make adjustments or repairs beyond the manufacturer's recommendations.

A respirator that has been used must be cleaned and disinfected before it is reissued. Emergency-use rescue equipment must be cleaned and disinfected immediately after each use.

Respirators must be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Protection against any mechanical damage also should be provided. Respirators should be stored so that facepieces and exhalation valves will rest in a normal position to prevent the rubber or plastic from reforming into an abnormal shape.

Respirators may be washed in a detergent solution and then disinfected by immersion in a sanitizing solution. Cleaner-sanitizers that effectively clean the respirator and contain a bactericidal agent are commercially available. The bactericidal agent frequently used is a quaternary ammonium compound. Strong cleaning and sanitizing agents and many solvents can damage rubber or elastomeric respirator parts. Such materials must be used with caution or after consultation with the respirator manufacturer.

Do You Need to Do Medical Evaluations?

Persons assigned to tasks that require the use of a respirator must be physically able to perform their work while using the respirator. The local physician or licensed health care professional must determine what health and physical conditions are pertinent. The employer must provide additional medical evaluations under the following four conditions:

1. When an employee reports medical signs or symptoms that are related to the ability to use a respirator.
2. The employer is informed by the physician or other licensed health care professional that the employee needs to be re-evaluated.
3. If during fit testing or respiratory program evaluation, a need for employee re-evaluation is found.
4. If there is a change in workplace conditions.

When respirators are worn in toxic atmospheres, the individual's body burden of specific toxins may be evaluated using appropriate laboratory tests. These may include urine, blood, or fecal analysis and other techniques to determine the intake and excretion of toxic substances. The findings of these tests, when correlated with other exposure data, such as air sampling data for wearers of such equipment, can serve as an indication of the effectiveness of the program. Positive evidence of exposure must be followed up with appropriate surveillance of work area conditions to determine if there is any relationship to inadequate respiratory protection or a need for additional engineering controls.

How Do You Monitor Work Areas?

Surveillance of the conditions in the work area and of the degree of worker exposure or stress (combination of work rate, environmental conditions, and physiological burdens of wearing a respirator) must be maintained. Changes in operating procedures, temperature, air movement, humidity, and work practices may influence the concentration of a substance in the work area atmosphere. These factors necessitate periodic monitoring of the air contaminant concentration. In instances where work is of such short duration that time to carry out the testing exceeds the time of the job, reasonable estimates of exposure are allowable.

In situations where the environment is or may be immediately dangerous to life or health (IDLH), employers shall ensure that one employee or, when needed, more than one employee is located outside the dangerous environment and that visual, voice, or signal line communication is maintained between the employees in the IDLH atmosphere and employee(s) outside. In interior structural firefighting situations employers must ensure that at least two employees enter the structure and remain in visual or voice contact with one another at all times. Also, at least two employees shall be located outside to provide effective emergency rescue.

What Equipment and Air Quality Standards Apply?

Respiratory protective devices must be approved by the National Institute for Occupational Safety and Health of the Department of Health and Human Services, for the contaminant or situation to which the employee is exposed.

Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration must be of high purity. Oxygen must meet the requirements of the United States Pharmacopoeia for medical or breathable oxygen. Breathable air must meet at least the requirement for Grade D breathable air described in Compressed Gas Association (CGA) *Commodity Specification G-7.1-1989*. Compressed oxygen must not be used in open circuit SCBAs or SARs that have previously used compressed air. Oxygen must never be used with air-line respirators.

Breathable air may be supplied to respirators from cylinders or air compressors. For testing cylinders, see *Shipping Container Specifications of the Department of Transportation (49 CFR Part 178)*.

Containers of breathable gas must be clearly marked (see *National Institute for Occupational Safety and Health, 42 CFR Part 84 requirements)*. Further details on the sources of compressed air and its safe use can be found in the CGA pamphlet G-7.1-1989, mentioned above.

The compressor for supplying air must be equipped with the necessary safety devices and alarms. Compressors must be constructed and situated to avoid any entry of contaminated air into the system and must be equipped with suitable in-line, air-purifying sorbent beds and filters installed to ensure air quality. If an oil-lubricated compressor is used, it must have a high-temperature or carbon monoxide alarm or both. If only the high-temperature alarm is used, the air from the compressor must be tested frequently for carbon monoxide.

Air-line couplings must be incompatible with outlets for other gas systems to prevent accidental servicing of air-line respirators with nonrespirable gases of oxygen.

What Other Help Can the PEOSH Program Provide?

The PEOSH Program has a variety of products and programs available to help employers comply with its regulations and improve workplace safety and health. These include numerous publications on regulatory topics, such as asbestos and bloodborne pathogens.

Occupational Safety and Health Program Guidelines

Effective management of worker safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. To assist employers and employees in developing effective safety and health programs, the PEOSH program published *PEOSH Occupational Safety and Health Program Guidelines*. These guidelines apply to all places of employment covered by PEOSH.

The guidelines identify four general elements that are critical to the development of a successful safety and health program:

- Management commitment and employee involvement,
- Worksite analysis,
- Hazard prevention and control, and
- Safety and health training.

The guidelines recommend specific actions, under each of these general elements to achieve an effective safety and health program.

Electronic Information

Internet—PEOSH standards, educational material and brochures are now on the World Wide Web at: http://www.state.nj.us/health/eoh/peoshweb.

PEOSH PROGRAM
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Facts About Respiratory Protection For Public Employees

Dear Reader:

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